dem3d -- Windows 95 Display Software for DEM Data
Users Manual
(Software version 1.0)
October, 1997

1.   Introduction

This manual is for *dem3d* Version 1.0. Earlier versions of the software may not contain

all the features documented here. Later versions may contain additional features, or behave differently.

The *dem3d* software runs on Windows NT and Windows 95. It installs using the **run** option located on the start menu. A box will appear in which you type the name of the program and Windows will open it for you. Or, double-click on the downloaded file in Windows Explorer.

dem3d displays U. S. Geological Survey native format digital elevation models (DEM). The program is a simple viewer. Its purpose is to provide fast and cheap data preview of USGS DEM data. It contains no editing, analysis, or other geographic information system (GIS) functions.

dem3d is public domain software and may be freely copied and distributed.

2.   Menu and Tool Bar Summary

Figure 1 shows the program Menu Bar and Tool Bar as they appear on startup.
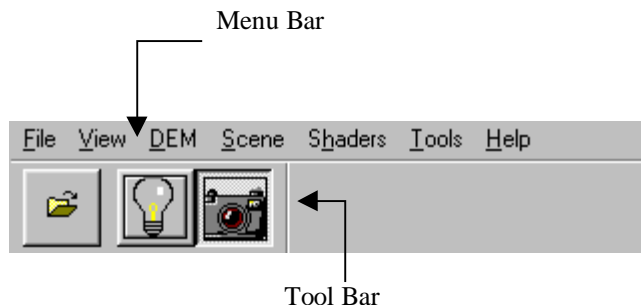
Figure 1. Menu and Tool Bar for *dem3d*

3.   Opening and viewing a DEM

This section explains the major features of the viewer. Section 4 contains some of the same information, and also contains more detail about viewer functions.

3.1.   Open DEM file

Select the **file** icon from the Tool Bar or select **[File/Open]** from the Menu Bar. A standard Windows 95 **open** window will appear. The file list shows files with extension **.**dem by default.

3.2.   Rotate, tilt and zoom

Select the **camera** icon on the Tool Bar, or select **[Tools/Move DEM]** from Menu Bar. Click and hold the left mouse button. The image will rotate as you move the mouse.

To zoom in, click and hold the right mouse button, then move the cursor toward the top of the display. To zoom out, move the cursor toward the bottom of the display.

3.3.   Move light source

DEM shading is done from a simulated light source. To move the light source, select the

light bulb icon on the Tool Bar or **[Tools/Light Source]** from the Menu Bar, then drag the light source with the mouse.

The model used for the simulated light source is this: imagine a sphere surrounding the DEM image. The light sits on the surface of this sphere, and may be dragged around on that surface. Since the mouse cursor moves in flat two dimensional space (the computer screen), it may be difficult to get a "feel" for the light movement relative to the cursor movement.

The light source appears as an asterisk-like symbol. In some positions it can be off the edge of the display. To reduce the size of the sphere (bring the light source closer to the data set), click and hold the right mouse button, then drag the cursor toward the top of the display (zoom in). To increase the size of the sphere, drag the cursor toward the bottom of the display (zoom out).

4. Image manipulation

This section contains descriptions of most viewer functions, as organized on the Menu Bar.

4.1. DEM

Functions under the **[DEM]** menu bar item control the basic characteristics of the image display.

4.1.1. Show Header Information

Select **[DEM/Show Header Info]** from the Menu Bar. A window will appear with cartographic metadata from the currently opened file.

4.1.2. Change Resolution

Select **[DEM/Resolution]** from the Menu Bar. A window with a slide switch appears. Grab the slider by clicking and holding with the left mouse button. Increasing the resolution will improve image quality, but will also increase screen refresh times.

4.1.3. Change Vertical Exaggeration

Select **[DEM/Vertical Exaggeration]** from the Menu Bar. Click and hold the slider switch with the left mouse button. Slide the switch to change the image vertical exaggeration.

4.1.4. Surface Properties

Select **[DEM/Surface Properties]** from the Menu Bar**.** A window appears with three parts: a shadow toggle, render type, and image highlights.

4.1.4.1. Shadows

Select the **shadows** toggle to turn shadows on and off. Turning shadows off has the effect of giving the surface uniform illumination. Although this can be done with any shader (see section 4.3), it makes sense only for shaders that use different colors. The daylight shader, for example, becomes a featureless gray slab without shadows.

4.1.4.2.   Render type

Flat shading uses simple rules to determine the intensity of the reflected light from the DEM. No smoothing is done, so the surface will retain its geometry at relatively high resolutions.

Smooth shading is a compromise between speed and visual quality. The DEM is shaded as with flat shading, but the colors of adjacent pixels in the same row are blended together. No blending is done between rows, which limits visual quality when zoomed in close.

Gouraud shading is a more sophisticated version of smooth shading. Image quality is better, but display times are longer. Technically, adjacent image pixels are polygon normal averaged at each vertex.

4.1.4.3.   Highlights

A highlight is an area where light reflects off a surface without taking on the color of the surface. The location of a highlight depends on the position of the light source, the position of the observer, and the geometry of the reflecting surface. In the real world, highlights also depend on the physical characteristics of the reflecting surface.

The two slide switches on this option allow you to alter how large and how bright the highlights are.

4.2.   Scene

Items on the **[Scene]** pulldown menu control the appearance of the environment in which the DEM is displayed.

4.2.1.   Camera Characteristics

This function is not implemented in the current software version.

4.2.2.   Light Source Characteristics

This function is not implemented in the current software version.

4.2.3.   Change Background Color

The default background color is black. To change it, select **[Scene/Background Color]** from the Menu Bar.

4.2.4.   Compass – Display Directions

To display labels for the eight primary compass points, select **[Scene/Compass]**. This is a toggle switch; to turn the direction labels back off, repeat the procedure. The compass points are all either displayed or not displayed.

4.2.5.   Grid –- Display Base Wireframe Grid

The software normally displays a flat grid below the elevation data. To turn this grid off,

select **[Scene/Grid].** This is a toggle switch; to turn the grid back on, repeat the procedure.

4.2.6. Caption – Display Quadrangle Name
To display the name of the quadrangle, select **[Scene/Caption]**. The quadrangle name is always displayed along the west edge of the image, and will appear reversed if the image is viewed from the west.

4.2.7. Options
This feature is not implemented in the current version of the software.

4.3. Shaders
A "shader" is a way of coloring or shading a DEM. Some of the shaders assign different colors to different ranges of elevations. Some show steeper areas in one color and flatter areas in another. Different shaders often reveal different data characteristics or subtle detail that might be overlooked with conventional data representations.

Following are non-technical explanations of the shader algorithms used by *dem3d*. These explanations will make the most sense if read while trying them in the software.

4.3.1. Daylight
The daylight shader uses a single grayscale value for every elevation in the DEM. This shader comes closest to showing what the actual terrain would look like in a black and white aerial photo.

4.3.2. HSV
HSV stands for "hue, saturation and value." This shader chooses a range of colors from the HSV color space. These colors are then assigned to the DEM so that one end of the range corresponds to the lowest elevation in the DEM and the other end of the range corresponds to the highest. This shader is colorful, and is useful for bringing out detail in DEM's that have small differences between the minimum and maximum elevations.

4.3.3. Slope
This shader colors flat areas one color and vertical areas another color. An area with a slope between perfectly flat and perfectly vertical is shaded with a combination of the two colors. Technically, the colors are blended using a linear combination of the flat and steep colors proportional to the slope.

4.3.4. Interval
Assigns colors to elevations from a fixed set of colors. In future versions of the viewer, the user will be able to select the colors and determine how the colors are mapped to the DEM.

4.3.5. Heading
Not operational at this time.

4.3.6. Terrace
This shader is unusual because it alters the elevations in the DEM. The elevations are snapped to a user-specified elevation interval (see Shader Options, section 4.3.9) and colored one of two alternating colors before being drawn. This can be used to generate crude contour lines.

4.3.7. Gradient
Colors the lowest elevation in the DEM one color, the highest elevation another. Elevations in between are some combination of the colors used for the lowest and highest elevation. This shader is most useful when shadows are turned off (see "Surface Properties") and the DEM is viewed from above.

4.3.8. Lake
This shader shows flat areas in blue, and other areas in green. The effect is to highlight areas that might be water bodies. DEM's do not contain feature information, so there is no way to tell from the data whether or not these areas are really bodies of water.

4.3.9. Shader options
Select **[Shader/Options]** to alter the colors for some of the shaders.

4.4. Tools

4.4.1. Move DEM
To rotate the image, select the **camera** icon from Tool Bar or select **[Tools/DEM]** from the Menu Bar. Click and hold the left mouse button. The image will rotate as you move the mouse.

4.4.2. Move Light Source
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The light source appears as an asterisk-like symbol, and will in some positions be off the edge of the display. To reduce the size of the sphere (bring the light source closer to the data set), click and hold the right mouse button, the drag the cursor toward the top of the display (zoom in). To increase the size of the sphere, drag the cursor toward the bottom of the display (zoom out).

4.5. Help

4.5.1. Help Topics
Online help is not implemented for this software version.

4.5.2. About dem3d
Select **[Help/About dem3d]** to display the version of the software.